Claims

1. A method for producing a positive electrode active material comprising:

a mixing step of mixing a plurality of substances to give a precursor, said substances proving a starting material for synthesis of a compound represented by the general formula $Li_xM_yPO_4$ where x is such that $0 < x \leq 2$, y is such that $0.8 \leq y \leq 1.2$ and M includes at lest one of 3d transition metals; and

a sintering step of sintering and reacting said precursor obtained by said mixing step;

wherein a reducing agent is added to said precursor in said mixing step.

2. The method for producing a positive electrode active material according to claim 1 wherein said $Li_xM_yPO_4$ is $LiFePO_4$.

3. The method for producing a positive electrode active material according to claim 2 wherein said reducing agent is Fe which is also a part of said starting material for synthesis.

4. A method for producing a non-aqueous electrolyte secondary battery having a positive electrode containing a positive electrode active material capable of reversibly doping/undoping lithium, a negative electrode mounted facing said positive electrode and capable of reversibly doping/undoping lithium, and a non-aqueous electrolyte interposed between said positive electrode and the negative electrode, said positive electrode active material being produced by a method comprising:

a mixing step of mixing a plurality of substances to give a precursor, said

substances proving a starting material for synthesis of a compound represented by the general formula $Li_xM_yPO_4$ where x is such that $0 < x \leq 2$, y is such that $0.8 \leq y \leq 1.2$ and M includes at lest one of 3d transition metals; and

a sintering step of sintering and reacting said precursor obtained by said mixing step;

wherein a reducing agent is added to said precursor in said mixing step to prepare said positive electrode active material.

5. The method for producing a non-aqueous electrolyte secondary battery according to claim 4 wherein said $Li_xM_yPO_4$ is $LiFePO_4$.

6. The method for producing a non-aqueous electrolyte secondary battery according to claim 5 wherein said reducing agent is Fe which is also a part of said starting material for synthesis.

7. A method for producing a positive electrode active material comprising:

a mixing step of mixing a plurality of substances to give a precursor, said substances proving a starting material for synthesis of a compound represented by the general formula $Li_xM_yPO_4$ where x is such that $0 < x \leq 2$, y is such that $0.8 \leq y \leq 1.2$ and M includes at lest one of 3d transition metals;

a de-aerating step of removing air contained in said precursor obtained in said mixing step;

a sintering step of sintering and reacting said precursor obtained by said mixing step.

8. The method for producing a positive electrode active material according to claim 7 wherein an inert gas is introduced after substituting vacuum for an atmosphere in said precursor and subsequently an inert gas is introduced to remove air contained in said precursor.

9. The method for producing a positive electrode active material according to claim 7 wherein a solvent is allowed to co-exist with the precursor in said de-aerating step and is vaporized off in said inert gas to remove air contained in said precursor.

10. The method for producing a non-aqueous electrolyte secondary battery according to claim 7 wherein said $Li_xM_yPO_4$ is $LiFePO_4$.

11. A method for producing a non-aqueous electrolyte secondary battery having a positive electrode containing a positive electrode active material capable of reversibly doping/undoping lithium, a negative electrode mounted facing said positive electrode and capable of reversibly doping/undoping lithium, and a non-aqueous electrolyte interposed between said positive electrode and the negative electrode, said positive electrode active material being produced by a method comprising:

a mixing step of mixing a plurality of substances to give a precursor, said substances proving a starting material for synthesis of a compound represented by the general formula $Li_xM_yPO_4$ where x is such that $0 < x \leq 2$, y is such that $0.8 \leq y \leq 1.2$ and M includes at least one of 3d transition metals;

a de-aerating step of de-aerating air contained in said precursor obtained in said mixing step; and

a sintering step of sintering and reacting said precursor obtained in a state free of air by said de-aerating step.

12. The method for producing a non-aqueous electrolyte secondary battery according to claim 11 wherein an inert gas is introduced after substituting vacuum for an atmosphere in said precursor and subsequently an inert gas is introduced to remove air contained in said precursor.

13. The method for producing a non-aqueous electrolyte secondary battery according to claim 11 wherein a solvent is allowed to co-exist with the precursor in said de-aerating step and is vaporized off in said inert gas to remove air contained in said precursor.

14. The method for producing a non-aqueous electrolyte secondary battery according to claim 11 wherein said $Li_xM_yPO_4$ is $LiFePO_4$.

15. A method for producing a positive electrode active material comprising:

a mixing step of mixing a plurality of substances to give a precursor, said substances proving a starting material for synthesis of a compound represented by the general formula $Li_xM_yPO_4$ where x is such that $0 < x \leq 2$, y is such that $0.8 \leq y \leq 1.2$ and M includes at lest one of 3d transition metals; and

a sintering step of sintering and reacting said precursor obtained by said mixing step;

wherein an electrically conductive agent is added to said starting material for synthesis or said precursor.

16. The method for producing a positive electrode active material according to claim 15 wherein said electrically conductive agent is added in an amount of 0.5 to 20 parts by weight to 100 parts by weight of said $Li_xM_yPO_4$.

17. The method for producing a positive electrode active material according to claim 15 wherein said $Li_xM_yPO_4$ is $LiFePO_4$.

18. The method for producing a positive electrode active material according to claim 15 wherein said $Li_xM_yPO_4$ is $LiFe_xMn_{1-x}PO_4$.

19. The method for producing a positive electrode active material according to claim 15 wherein said $Li_xM_yPO_4$ is $Li_xMn_yPO_4$ where x is such that $0 < x \leq 2$ and y is such that $0.8 \leq y \leq 1.2$.

20. The method for producing a positive electrode active material according to claim 15 wherein said electrically conductive agent is carbon.

21. A method for producing a non-aqueous electrolyte secondary battery having a positive electrode active material capable of reversibly doping/undoping lithium, a negative electrode mounted facing said positive electrode and capable of reversibly doping/undoping lithium, and a non-aqueous electrolyte interposed between said positive electrode and the negative electrode,

wherein said positive electrode active material is synthesized by a mixing step of mixing a plurality of substances to give a precursor, said substances proving a starting material for synthesis of a compound represented by the general formula $Li_xM_yPO_4$ where x is such that $0 < x \leq 2$, y is such that $0.8 \leq y \leq 1.2$ and M includes

at lest one of 3d transition metals and a sintering step of sintering and reacting said precursor obtained by said mixing step, and wherein an electrically conductive agent is added to said starting material for synthesis or to said precursor to synthesize said positive electrode active material.

22. The method for producing a non-aqueous electrolyte secondary battery according to claim 21 wherein said electrically conductive agent is added in an amount of 0.5 to 20 parts by weight to 100 parts by weight of said $Li_xM_yPO_4$.

23. The method for producing a non-aqueous electrolyte secondary battery according to claim 21 wherein said $Li_xM_yPO_4$ is $LiFePO_4$.

24. The method for producing a non-aqueous electrolyte secondary battery according to claim 21 wherein said $Li_xM_yPO_4$ is $LiFe_xMn_{1-x}PO_4$.

25. The method for producing a non-aqueous electrolyte secondary battery according to claim 21 wherein said $Li_xM_yPO_4$ is $Li_xMn_yPO_4$ where x is such that $0 < x \leq 2$ and y is such that $0.8 \leq y \leq 1.2$.

26. The method for producing a non-aqueous electrolyte secondary battery according to claim 21 wherein said electrically conductive agent is carbon.